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Target species selection criteria for risk assessment based exemptions of ballast water management requirements

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Target species selection criteria for risk assessment based exemptions of ballast water management requirements

Abstract

The Ballast Water Management Convention adopted at the International Maritime Organization (IMO) allows exemptions from ballast water management requirements. These exemptions may be granted when a risk assessment results in an acceptable low risk scenario. IMO has adopted a guideline describing different risk assessment approaches (G7 Guidelines, 2017). One approach is a species-specific risk assessment in which so called target species (TS) become important. TS are species that meet specific criteria indicating that they may impair or damage the environment, human health, property or resources and they are defined for a specific port, State or biogeographic region. The guidelines continue to describe general TS selection criteria, which include the species relationship with ballast water as a transport vector, their impact type and severeness, evidence of prior introduction(s), and its current distribution. However, the G7 Guidelines lack details how these criteria are to be defined. This paper presents the TS selection criteria developed during the EU-Interreg Baltic Sea Region COMPLETE project (Completing Management Options in the Baltic Sea Region to Reduce Risk of Invasive Species Introduction by Shipping), including explanations on what ballast water relationship means, which impact threshold is eligible to identify a TS, as well as

why prior introductions and the current species distribution are relevant in that context. It was concluded that TS lists need to be regularly reviewed and that the described TS selection criteria may be also adopted elsewhere when planning species-specific risk assessments for exemptions from ballast water management requirements.

1 Introduction[1]

IMO developed a detailed RA to evaluate the risk of species transferred by ballast water in the G7 Guidelines (IMO, 2007a) and these guidelines were recently updated (IMO, 2017). Two fundamentally different RA approaches were developed under the IMO BWM Convention, i.e., the selective and the blanket approach (IMO, 2017). This was done to avoid placing a burden, in form of a "one suits all" BWM requirement, on all ships. Such a blanket approach would result, in low risk cases, in unnecessary BWM requirements, which would trigger unnecessary costs and chemical burden for the aquatic environment caused by ballast water treatment. In contrast, the selective approach means that BWM measures are required according to the different risk levels posed by the ballast water intended for discharge. The RA result may trigger that ships are exempted from BWM requirements if the ballast water discharge risk level is acceptable (David et al., 2013, 2015; Olenin et al., 2016; David and Gollasch, in press). On the opposite, i.e., if (very) high risks are assessed, additional measures may need to be taken by ships which are to be based on the G13 Guidelines (IMO, 2007b). In the Annex to the BWM Convention, Regulation A-4 provides an approach to issue exemptions from Regulation B-3 (Ballast Water Management for Ships) and also Regulation C-1 (Additional Measures) to address high risks (IMO, 2004).

IMO RA outlines three different RA methods, that is "environmental matching", "species' biogeographical" and "species-specific" RA (IMO, 2017). Environmental matching RA between ballast water origin and discharge areas uses non-biological parameters as surrogates for the survival potential of species in the new environment. In the species' biogeographical

[1] Ballast water management (BWM), Baltic Marine Environment Protection Commission (HELCOM), Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), Decision Support System (DSS), European Union (EU), Framework Programme (FP), harmful aquatic organisms and pathogens (HAOP), International Maritime Organization (IMO), Instrument for Pre-Accession Assistance (IPA), Joint Harmonised Procedure (JHP), risk assessment (RA), target species (TS), task group (TG).

RA species are identified which have overlapping distribution in donor and recipient ports as well as biogeographic regions. Such an overlap is taken as direct similarity indication of the environmental conditions and hence the likeliness of species survival in the new environment. The species-specific RA considers the life history information and also physiological tolerances to identify the physiological limits of species. This is done to estimate the species` potential to survive or to complete the entire life cycles in the new environment and this method considers target species (TS) (IMO, 2017). According to the G7 Guidelines the risk could be deemed to be high, e.g., if the species-specific RA identifies at least one TS that occurs in the donor port/area, but not in the recipient port, and that its survival is likely in the recipient port. Furthermore the G7 Guidelines specify that *a priori* criteria should be defined so that unacceptable high risk scenarios and acceptable low risk scenarios, where unmanaged ballast water is unlikely to damage or impair the environment, human health, property or resources of the port State or adjacent/other States, may be distinguished (IMO, 2017). It is therefore up to the port State granting the exemption, in consultation with other States that may be affected, to determine what constitutes an unacceptable risk.

According to IMO, TS are species that "meet specific criteria indicating that they may impair or damage the environment, human health, property or resources and are defined for a specific port, State or biogeographic region" (IMO, 2017). It should be noted that IMO does not distinguish between TS already introduced and those not yet introduced. According to the definition in the G7 Guidelines (IMO, 2017), at least all the following criteria have to be considered for the TS identification (David and Gollasch, 2018): (a) the relationship with ballast water as a transport vector, (b) the impact and its severeness, (c) the evidence of prior introduction(s), and (d) the current species distribution in its native biogeographic region and also in other biogeographic regions, as appropriate.

In addition, several attempts were made to identify common biological characteristics of ‘perfect’ invasive species, which could be assumed as TS. In summary, a ‘perfect’ invasive species will show wide tolerances towards environmental factors and have high reproduction rates (Safriel and Ritte, 1980, 1983; Kareiva, 1999; Hewitt, 2003; Rewicz et al., 2014). These species should therefore also be considered as TS candidates in addition to the species which meet the IMO selection criteria, which do not address biological characteristics.

First considerations of TS in European Seas were conducted in 1999 (Gollasch and Leppäkoski, 1999) and this approach was updated in 2006 (Leppäkoski and Gollasch, 2006). These approaches were based on expert opinion and were prepared before the first G7 Guidelines were adopted at IMO in 2007 and are therefore considered as outdated. In 2013, HELCOM and OSPAR adopted the Joint HELCOM/OSPAR Guidelines to grant exemptions under the BWM Convention, Regulation A-4 (subsequently renamed JHP), which contain a list of TS for these regional seas in Annex 3 (HELCOM, 2013). More recently, the TS list was revised and endorsed by the Heads of Delegation of HELCOM (HELCOM, 2015a) and OSPAR in June 2015 (OSPAR, 2015a). The majority of the HELCOM countries are prepared to use this TS list, which contains 41 species, for the purpose of BWM exemptions according to the BWM Convention. The TS list is considered to be a living document (HELCOM, 2015b; OSPAR, 2015b) so that changes are to be expected as need arises.

The JHP is currently under a revision process which is expected to conclude during 2020-2021. As part of this process the TS selection criteria were amended and adopted in 2016 (HELCOM/OSPAR TG Ballast, 2016). Nevertheless, these criteria, like the G7 Guidelines, leave out a detailed description of the identification of TS. In the case of the G7 Guidelines, this may be due to the lack of knowledge and experience during the drafting phase of these guidelines. Now, more than a decade since the G7 Guidelines were adopted, several research projects addressed species-specific RA. Based on the review of current knowledge on the subject, detailed TS selection criteria have been identified within the ongoing EU-Interreg Baltic Sea Region project COMPLETE and are presented in this publication.

2 Material and Methods

The previously developed species-specific RA and TS literature, as indicated above, was revisited to evaluate their today's applicability to describe TS selection criteria. In addition, a comprehensive literature review was performed and the TS-related information in these documents was considered (see Table 1 for references).

Authors	**Goals**	**RA approach**	**Data expression approach**	**End-point**

Authors	Goals	RA approach	Data expression approach	End-point
Hayes and Hewitt, 1998; Hayes, 2000; Hewitt and Hayes, 2002; Hayes and Sliwa, 2003; Hewitt and Campbell, 2007	Identification of low risk routes, vessels and tanks	Four step bio-invasion process: donor port infection, vessel infection, journey survival and survival in recipient port	Quantitative	Completion of TS life cycle in recipient port
Gollasch and Leppäkoski, 1999	Risk identification for Nordic ports and coastal waters	Environmental match of donor and recipient localities	Qualitative	Species establishment potential assessment, list of TS
Behrens et al., 2002; Endresen et al., 2004; Dragsund et al., 2005	Identification of low risk routes, vessels and tanks	Bioinvasion model based upon: donor port infection, vessel infection, journey survival and survival in recipient port	Quantitative	Completion of TS life cycle in recipient port

Authors	Goals	RA approach	Data expression approach	End-point
MacIsaac et al., 2002	Evaluation of risk with NOBOB[2] vessels (Great Lakes)	Species tolerances and propagule pressure of NOBOB vessels	Quantitative	Journey survival of TS
GloBallast, 2003; Awad et al., 2004	Awareness and recommendations on BWM strategies	Environmental match of donor and recipient localities, weighted by TS presence in the donor location and inoculation factors	Semi-quantitative	Identification and ranking of high and low risk ports
MacIsaac et al., 2004	Review and development of a ballast water RA	TS (gravity model, i.e., rates and pattern of colonization)	Quantitative	Colonization prediction of TS
David, 2007; David and Gollasch, 2016	Vessel-to-vessel (tank) assessment for BWM measures supported by DSS	Environmental match of donor and recipient localities (bioregions) & species-specific (inside bioregion)	Quantitative & qualitative	Identification and ranking of high and low risk donor ports & identify high risk species

[2] NOBOB = no ballast on board

Authors	Goals	RA approach	Data expression approach	End-point
Heyer, 2012	Evaluation of BWM exemptions in North and Baltic Seas	TS and their environmental tolerance comparing donor and recipient port conditions	Quantitative & qualitative	RA
Berggreen et al., 2013	BWM exemptions	TS selection	Qualitative	RA
Puntila et al., 2013	BWM exemption, list of most unwanted species	TS selection criteria	Qualitative	RA
David et al., 2015	BWM exemptions	Environmental match of donor and recipient localities (bioregions) & species-specific (inside bioregion)	Quantitative & qualitative	RA
Zenetos, 2015	Selection of most impacting species	Rapid assessment surveys	Qualitative	High risk
Olenin et al., 2016	BWM exemptions	Six major components including TS selection procedure	Qualitative	RA

Table 1. Chronological list of ballast water related RA initiatives addressing TS (enhanced and updated after David and Gollasch (2016)).

Further, the BWM Convention and the G7 Guidelines together with JHP were studied with the RA-related work of previously completed EU-funded projects, i.e., the EU 7th FP project VECTORS[3] (David and Gollasch, 2014) and the IPA-funded project BALMAS[4] (David and Gollasch, 2016), to gather additional information regarding which TS selection criteria had been considered previously. During the ongoing EU-Interreg project COMPLETE all findings were re-considered and discussed.

2.1 Terminology used

The term HAOP is used in the BWM Convention. It is defined as "any aquatic organisms or pathogens, which, if introduced into the sea including estuaries, or into fresh water courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas" (IMO, 2004). In consequence, HAOP include all potentially harmful non-indigenous and cryptogenic as well as impacting native aquatic species and pathogens (David et al., 2013; Gollasch et al., 2015). Impacting native aquatic species may include species causing harmful algal blooms, aquaculture pests, parasites and disease agents (Olenin et al., 2016). Therefore, and in line with the precautionary principle, all HAOP are potential TS (David et al., 2013; David and Gollasch, 2016).

[3] Vectors of Change in Oceans and Seas - Marine Life, Impact on Economic Sectors
[4] Ballast Water Management System for Adriatic Sea Protection

2.2 Additional guidance for TS selection criteria

Considering the G7 Guidelines in detail (IMO, 2017), a questionnaire to identify TS was developed (Olenin et al., 2016). The content of this questionnaire was used as additional guidance to identify and describe the TS selection criteria. This questionnaire, which was based upon eleven questions and sub-questions, addressed mainly the relationship with ballast water, the basic ecology of the species and its impact on native species, the environment, human health and resource users. The answers to these questions were based upon scientific literature and expert knowledge to identify TS in selected ports.

3 Results

3.1 Selection criteria of target species

The TS selection criteria as described below are completely in line with the G7 Guidelines (IMO, 2017) and we also considered the TS selection approach as set out in the amended JHP for the Contracting Parties of OSPAR and HELCOM for granting BWM exemptions (HELCOM/OSPAR TG Ballast, 2016). It was noted that the G7 Guidelines TS identification criteria are more specific compared to JHP. According to JHP (HELCOM/OSPAR TG Ballast, 2016), two key questions should be addressed before a species is considered for TS list inclusion (a) “Is there a potential for a species to be primarily introduced or secondarily spread via ballast water or sediments as the major vector?”, and (b) “Is the species present only in part(s) of the region but not the entire region in self-sustaining populations?”. In addition to these general aspects, “any impact” on human health, environment or economy identifies species for inclusion of the TS list. However, “any impact” is not further specified in the revised JHP TS selection criteria (HELCOM/OSPAR TG Ballast, 2016).

In the text that follows below, concrete and detailed TS selection criteria are described in order of importance based on current knowledge as well as the G7 Guidelines (IMO, 2017).

3.1.1 Species relationship with ballast water as transport vector

A positive species relationship with ballast water is given when it was previously found in a ballast tank or in cases when the species life cycle has a larval phase or planktonic adult as this makes a ballast water transport likely. In the many ballast water sampling studies conducted in the past living viruses, bacteria, human pathogens, fungi, protozoa, algae (unicellular phytoplankton algae and macroalgae), invertebrates and fish were found. The predominantly found species belonged to planktonic algae, crustaceans, molluscs and polychaetes. More than 1,000 species were identified in European ballast water studies. Most species were of small dimension so they withstand the physical forces of the vessel ballast water pumps during ballasting. However, some larger organisms were also found in ballast tanks, including decapods and fish with a body length up to 15 cm (Gollasch et al., 2002, 2015; AquaNIS. Editorial Board, 2015).

Many aquatic species life cycles include a planktonic or spreading phase and therefore all those species have a relationship with ballast water so that they could become TS. The spreading phase duration is neglected here as TS qualifier to implement the precautionary principle. This is because a shorter spreading phase does not disqualify a species from being

TS in case of shorter vessel voyages, i.e., when the voyage is shorter than the spreading phase duration. The shortest spreading phase we are aware lasts only for minutes and this occurs during the development of the hydrocoral *Allopora californica* (Shanks, 2009). Other species have relatively short-lived spreading phases of a few hours up to a day with *Didemnum* spp. (Olson, 1983; Daley and Scavia, 2008; Gittenberger, 2010) and the sponge *Sigmadocia caerulea* being examples (Maldonado and Young, 1999). In contrast, long-lasting spreading phase durations of more than 200 days (Kempf, 1981) or up to a year were observed for several mollusks (Strathmann and Strathmann, 2007). As an example, in the Öresund (Baltic Sea) ca. 63% of the species have long planktonic larvae, 6% short (<1 week) planktonic larvae and 31% develop without planktonic larvae (Thorson, 1946). Similar results were also found in a North American study (Grantham et al., 2003). In a study to compare larval durations of almost two hundred species of various higher taxonomic groups it was observed that for 80% of the species the larval duration is between a few days and six weeks (Tardent, 1979), which was also found by others (Shanks, 2009). Therefore, even spreading phase phases of a few hours do not guarantee that this species cannot be transported into the recipient port when the voyage is short or when reproduction inside a ballast tank is possible. Further, species may spread by fragmentation or form of resting stages, no matter how long the larval duration is, thereby surviving also longer vessel voyages. In conclusion, the only species not to be categorized as TS are only those which:

- lack a planktonic phase completely;
- live so deep in the sediment that they cannot be stirred up into the water column and be pumped into a ballast tank; or
- are in all developmental stages relatively large so that it is impossible that they pumped on board (e.g., larger fish, turtles).

3.1.2 Impact and its severeness

Concerning the impact of species, it is suggested to differentiate within each impact category (human health, economy and environment) between acceptable and non-acceptable impact. Impact on health and measurable economic impact should always be considered as unacceptable. Accordingly, all human pathogens (more than limited in regulation D-2 of the BWM Convention, e.g., *Streptococci*, *Staphylococci*, *Pseudomonas*, *Salmonella*) and other species and/or strains than specified in D-2) and species with documented measurable economic impact are TS no matter the impact strength. The potential species environmental impact may be evaluated by applying impact categorization concepts (Olenin et al., 2007), which were also used in the BALMAS project (Garaventa et al., 2014; Magaletti et al., 2018). The biopollution assessment concept (Olenin et al., 2007) uses non-indigenous species (NIS) distribution information and abundance and includes an index which classifies impacts on native species, communities, habitats and ecosystem functioning. This concept enables assessments from being as low as the absence of any measurable impacts and it ends with high impacts as with major shifts or even catastrophic perturbations in the native community structure, habitat properties and ecosystem functioning (Olenin et al., 2007).

Based on the above mentioned differentiation, it is recommended that one threshold between acceptable and unacceptable impact based on their categorization is established (Olenin et al., 2007). This would also be in line with the recent JHP impact categories (HELCOM, 2015a). A low impact is characterized by (HELCOM, 2015a; Olenin et al., 2007):

- "local displacement of native species, but no extinction. Change in ranking of native species, but dominant species remain the same. Type-specific communities are present[5];
- alteration of a habitat(s), but no reduction of spatial extent of a habitat(s)[6];
- measurable, but weak changes with no loss or addition of new ecosystem function(s)[7]; or
- measurable, but weak changes with no loss or addition of resources.[8]"

Species already in this impact category are seen as critical, and, following the precautionary principle, their introduction should be avoided. It is therefore suggested to define the threshold acceptable-unacceptable impact between the "No impact" and "Low impact" category (Table 2). This approach re-organizes some criteria formerly developed by Olenin et al. (2007) into now one category, i.e., unacceptable.

Regarding environmental impacts, these may occur at different levels (species, habitat, ecosystem functioning level). During BALMAS the impact on resource users was added to (a) complete the assessment concept of the impacts species may cause and to (b) fully reflect the IMO definition, i.e., impacting on the environment, human health, property or resources (David and Gollasch, 2016).

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[5] One example is the non-indigenous barnacle *Elminius modestus* along the German North Sea coast. It overgrowths and occupies space so that it competes with other epifaunal species as, e.g., the native barnacle *Balanus balanoides* (Nehring 2005).

[6] The tube-building amphipod *Chelicorophium curvispinum* is one example to alter habitats, another example is the infaunal polychaete *Marenzelleria neglecta* due to its burrowing activity (Olenin and Leppäkoski, 1999; Kotta et al., 2001).

[7] No loss or addition of new ecosystem function may be observed following the occurrence of, e.g., a non-indigenous suspension feeder with the same function as native species. An example is the barnacle *E. modestus* along the German North Sea coast (Nehring, 2005).

[8] An example to demonstrate this impact is *Antithamnionella ternifolia* in the North Sea. It occurs scattered from France to Germany. In general it has a weak fouling impact. On Dutch oyster cultures it is found only on < 1 % of the individuals (Isermann and Nehring 2017).

Further, species where no impact information is available should be included to the TS list as a precautionary approach.

Impact category	**Impact on species**	**Impact on habitat**	**Impact on eco-system functioning**	**Impact on resource users**
Acceptable	No displacement of native species, although NIS may be present. Status of native species according to quantitative parameters in the community remains unchanged	No habitat alteration	No measurable effect	No measurable effect
THRESHOLD				
Unacceptable	Local displacement of native species, but no extinction. Change in ranking of native species, but dominant species remain the same. Type-specific communities are	Alteration of a habitat(s), but no reduction of spatial extent of a habitat(s)	Measurable, but weak changes with no loss or addition of new ecosystem function(s)	Measurable, but weak changes with no loss or addition of resources

Impact category	Impact on species	Impact on habitat	Impact on eco-system functioning	Impact on resource users
	present			
	Large scale displacement of native species causes decline in abundance and reduction of their distribution range within the assessment unit; and/or type-specific communities are changed noticeably due to shifts in community dominant species	Alteration and reduction of spatial extent of a habitat(s)	Moderate modification of ecosystem performance and/or addition of a new, or reduction of existing, functional group(s) in part of the assessment unit	Moderate modification of resources and/or addition of a new, or reduction of existing, resources in part of the assessment unit
	Population extinctions within the ecosystem. Former community dominant species still present but their relative abundance is severely reduced; NIS are dominant. Loss of	Alteration or loss of habitat(s), severe reduction of spatial extent of habitat(s)	Severe shifts in ecosystem functioning. Reorganisation of the food web as a result of addition or reduction of functional groups	Severe shifts in resources with income loss for resource users

Impact category	**Impact on species**	**Impact on habitat**	**Impact on eco-system functioning**	**Impact on resource users**
	type-specific community within an ecological group		within trophic levels	

Table 2. HAOP environmental impact categories (modified after Olenin et al. (2007)).

3.1.3 Evidence of prior introduction(s)

When all HAOP of the donor port/area are considered, species which are documented as to be introduced to areas outside of their native ranges are potential TS as their ability to spread is self-evident.

3.1.4 Current distribution

An assessment to determine whether a HAOP is present in the donor port/area but not in the recipient port may be carried out. However, this has to be based upon port baseline sampling surveys due to the reliable data requirement (HELCOM, 2013; HELCOM/OSPAR TG Ballast, 2016; IMO, 2017). In addition, the distribution of HAOP in their native and other biogeographic regions has to be evaluated. Consequently, a wide biogeographical or habitat distribution makes a species to be considered as potential TS. Further, species known as HAOP in other biogeographic regions are also considered as potential TS.

The current species distribution has an influence on the species impacts. By simple logic, only species with a wide distribution may result in the highest category of impact. This means that, e.g., only widely distributed species may cause large-scale displacements or extinctions of other species. Nevertheless, a small-scale distributed species with local impact may be of unacceptable consequence should it overlap in distribution with a rare or endangered species, especially when this has a restricted distribution. In such a case, even a HAOP with a limited distribution may be responsible for a strong impact as it may lead to an extinction of a rare or endangered species.

Further, locally distributed species may result in a strong resource user's impact. One example is the fouling species *Ficopomatus enigmaticus* which during mass developments clogged industrial water pipes in a small area in the Port of Emden (Germany), which was enabled by elevated water temperatures due to discharges of heated power plant effluents (Kühl, 1977). After some time of adaptation it spread further increasing its distribution area and consequently it caused a stronger impact.

4 Discussion

One of the difficulties in identifying TS is the possible subjectivity in their selection process. Without clear guidance it is possible that the assessment if a species should become a TS or not exhibits a degree of uncertainty, i.e., species identified as harmful in some areas may not be harmful in others or vice versa (David et al., 2013). As a consequence, species may be considered as TS in one region but not elsewhere. Also, different experts in one region may evaluate the identical species as TS or not. To overcome this problem, the above outlined TS selection criteria were developed.

Despite best efforts, several challenges remain and these include that native species in one region may become invasive when they were transported to another region. Further, an introduced species of no concern (a non-TS) in a donor port/area may become invasive when transported elsewhere (Carlton and Geller, 1993).

It was further concluded that a species, that has been included in a control or in an eradication program in any ballast water donor port/area will become TS. It is therefore recommended to consider these species with priority. The reasoning is that in case others try to control or eradicate a species it is because of its strong negative impact, and a recipient port will not agree to receive unmanaged ballast water from a donor port/area where such species occurs. However, this is seen as additional information as it will be impossible to evaluate for all species found during a port survey whether they underwent a control or eradication program elsewhere. In contrast, should a species control or eradication programme be ongoing in the recipient port, a re-introduction of individuals of that species would be seen as an undesirable event thus these species become TS. This important point is frequently overlooked.

The above-mentioned TS selection criteria are partly connected with each other and therefore have to be assessed in a step-by-step process. For example, a strongly negatively impacting species, which has no larval or spreading phase, will not be seen as TS as it cannot be transported by ballast water. As another example, a wide spread species, which occurs in low numbers may cause no impact and is therefore not seen as TS.

We conclude that a step-wise approach to evaluate whether or not species are considered TS is needed:

Step 1 - List all species found during the current JHP port baseline surveys (and if available additional data from other surveys) of both/all ports involved under consideration for BWM exemptions.

Step 2 - Compare species sampled during JHP port baseline surveys with all species on the existing HELCOM/OSPAR TS list. Any matching species found in the ports to be considered, are identified as TS.

Step 3 - For the remaining species, additional TS should be selected using the criteria which identify those species which have the ability to invade and become harmful. At least all following criteria need to be considered when identifying TS:

1. relationship with the transport vector ballast water, i.e., species which were already found in ballast tanks or which includes a larval phase or planktonic adult to make a ballast water transport likely. Species unknown to be ballast water related cannot become a TS in this context;
2. impact and its severeness, i.e.; does the species cause a measurable impact? It was agreed that the impact to human health (pathogens) should be prioritized, followed by economic impact, followed by environmental impact. In this sense all human

pathogens and species with an economic impact are TS no matter how strong the impact is. Only for environmentally impacting species the impact severeness is assessed. Only species assessed as with higher than low impact are considered as TS. The species assessed as with low impact would also be categorized as TS when expert opinion reveals that impacts may be increasing;

3. evidence of earlier introduction(s) elsewhere, i.e., the species ability was documented that it became introduced outside its native area. The evidence of prior introduction gives an indication on the potential of the species to spread. Once a species has shown its potential to spread it becomes a potential TS. However, no evidence of prior introduction gives no guarantee that the species may not be introduced to the concerned port(s). Please note that the spreading potential of the species may change according to the changes in the port environments; and
4. current distribution in its native biogeographic and in other biogeographic regions has to be evaluated. Species with a wide biogeographical or habitat distribution or species which are invasive elsewhere, are categorized as potential TS.

Step 4 - Prepare a list of all TS in both/all ports. It is recommended conducting this in a transparent format, i.e., develop a species evaluation sheet that the reader can see which criterion applies to a certain species and which not. This may be done in table format including references when available.

The existing HELCOM/OSPAR TS lists need to be reviewed. In the past the TS selection criteria were not clearly formulated and some species came on the list purely because of expert opinion. Only those species that meet the criteria as listed above should remain on this list. It was recommended that the new HELCOM TS list may transparently be developed, i.e., as a list where the criterion/criteria to identify TS are clearly attributed to individual species on the list.

It is further recommended that the here described and explained TS selection criteria may be adopted in other activities when planning species-specific RA for exemptions from BWM requirements, e.g., when considering the Same Risk Area concept as defined the G7 Guidelines (IMO, 2017).

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